

Carbon Dynamics

Topics

Old Topics:

- Changes in seasonal amplitude of CO₂ concentrations
- CH₄ data/knowledge gaps
- Aquatic carbon fluxes
- Partitioning NEE = GPP+RESP
- C Flux measurements in permafrost ecosystems

New Topics:

- Carbon budget
- Scaling
- Improved characterization of model uncertainty
- Feedbacks

Possibilities:

New tools provided by COS, Isotopes and

CO₂ Seasonal amplitude

What do we know?

- GPP is a critical driver
- Respiration is playing role but unclear how much

Big questions?

- Where? → Large scale observations of CO₂ show increase but not capable of detecting the origin of the signal.
- How? → Once we know the region we can start building plausible models to explain the increase in amplitude of CO₂

CH₄ Emissions

What we know:

- Atmospheric burden is increasing but inverse estimates do not see the Arctic as a source of this increase
- Methanogenesis is always happening where there is liquid water (i.e. not frozen).

Big questions:

- What is regulating the emissions into the atmosphere?
- Spatial scales of emissions?

Aquatic Fluxes

- What do we know?
 - Mackenzie and Yukon show increased weathering based on increased export of old carbon in rivers (20– 40 years of data)
 - Landscape thaw doesn't lead to much C export into lakes
 - Lakes impacts are variable to carbon fluxes
 - Streams and rivers are the big players
- What don't we know?
 - If permafrost melt is the source of increased export
 - Not good way to quantify lake age and impact on carbon cycle (autotrophic/heterotrophic)

Partitioning of NEE

What we know:

- North slope enhancements of CO₂ and CH₄ in early cold season indicates a respiration sources
- Enhancements in GPP

Big questions:

- We really don't know the magnitude of GPP
 - How to separate autotrophic and heterotrophic respiration
- How limiting factors (temperature, water, light) are changing over time
- Winter time

New Tools:

- SIF and COS provide a more direct signal of photosynthesis
- O₁₈ and C₁₃ can help, but need modeling investment

Arctic Carbon Budget

What do we know:

- Well defined budget for Alaska, less so for Canadian portion
- Below ground budget updated annual
- Above ground budget is improving!

What don't we know:

- Methane
- Fluxes (NEE, GPP, Resp, lateral fluxes)

Feedbacks

- What do we know?
 - CO₂ cycling responding to warming
 - The carbon cycle is accelerating, leading to more fall respiration, along with increased GPP
challenging detection of permafrost carbon
- What don't we know?
 - CH₄ emissions response to warming
 - Attribution of greening to climate or CO₂ fertilization